Sudbury Neutrino Observatory High Energy Event Analyses

C.E. Okada, Y.D. Chan, M. Dragowsky, K.T. Lesko, E.B. Norman,
M.C. Perillo Isaac, A. Schuelke, R.G. Stokstad

Although the primary goal of the Sudbury Neutrino Observatory (SNO) is the measurement of the interactions between neutrinos coming from the Sun and the heavy water of the detector, there will be a sizable number of events resulting from muons and neutrinos produced in the atmosphere. These events will be interesting and useful for many reasons:

- They will typically be much higher in energy than the solar neutrino events ($>$ 100 MeV *vs.* $<$ 20 MeV), thus they should be easily recognized as particle interactions and provide quick check of the fitting algorithms.
- Muons which stop in the central volume of the detector will decay to two neutrinos and an electron with a decay constant of $2.2\mu s$. The Known presence of this electron can be used to test particle identification.
- The tail on the energy spectrum of the decay electrons can provide a way to check the energy calibration in the higher range of the solar neutrino spectrum.
- The decay electrons in the tail may also serve as a background to the solar neutrino signal.
- The passage of a muon through the detector can produce radioactive isotopes whose decays, which can occur several seconds after the muon, will be seen as backgrounds to the solar neutrino measurement.
- Other experiments have reported discrepencies in the ratio of muon-like and electron-like events produced by atmospheric neutrinos[1, 2]. Data from SNO can lend more strength to these claims.

Analyses which isolate the high energy events, and any delayed events which might have been associated with them, are being developed to attack these issues.

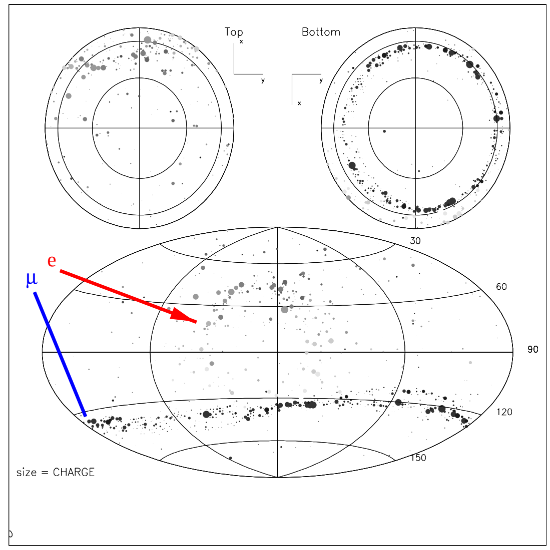

Figure 1: Event display of a simulated 300 MeV muon with its decay electron. The figure shows two projections of the event. The upper half of the figure shows the top an bottom hemispheres as viewed from the center. The lower half of the figure shows the sphere unrolled. The muon travels directly down and creates the ring around the lower half of the detector. The electron creates a more diffuse ring which comes out of the picture. In this event, the hits associated with the electron are delayed by approximately $1.9\mu s$ relative to the muon hits.

References

[1] K.S. Hirata *et al.*, Phys. Lett. **B283**, 446 (1992).

[2] Y. Fukuda *et al.*, Phys. Lett. **B335**,237 (1994).